BLISTER-RUST CONTROL

MASSACHUSETTS

MANUAL FOR FIELD MEN

MASSACHUSETTS AND UNITED STATES
DEPARTMENTS OF AGRICULTURE
COOPERATING

F A C T S

T H A T

M A S S A C H U S E T T S

B L I S T E R - R U S T F I E L D M E N

S H O U L D K N O W

Compiled by C. C. Perry, Agent
State Blister-Rust Leader

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The material assembled in this manual has been taken from the most reliable sources of available information. It seems unnecessary to cite the sources in a text of this type. In the preparation of the manual, free use without acknowledgment, has also been made of material released through the Division of Blister Rust Control, Bureau of Plant Industry, United States Department of Agriculture at Washington. The cooperation of Mr. Roy G. Pierce of that division has been invaluable in the prepararion of the first three printings of this aid to blister rust field men. It is believed that this fourth revision has been improved by the addition of excerpts from material prepared by Mr. E. C. Filler under the title - "Field Methods of Eradicating wild currant and gooseberry bushes."

Room 136 State House, Boston, Massachusetts.
January 1, 1934

C. C. Perry

FOREWORD

The facts recorded herein have been compiled primarily for the information and benefit of the field men employed on blister rust control work in the State of Massachusetts. Read the material carefully, study it, and retain it for ready reference as occasion may require. An effort has been made to touch briefly and simply upon the more important subjects that may be met with in connection with the field work.

After reading the material as presented herewith, if you find anything that is not entirely clear to you, get in touch with the blister-rust control agent to whom you are responsible, and go over the matter with him personally.

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FACTS ABOUT THE DISEASE - BLISTER RUST — PAGE

F A C T S A B O U T T H E D I S E A S E - B L I S T E R R U S T

WHAT BLISTER RUST IS: Blister rust is a plant disease which is caused by the growth of a parasitic fungus within the inner bark of the white pine tree and in the leaf tissues of Ribes (currant and gooseberry bushes), pronounced Rye-bees.

NAME OF THE FUNGUS: CRONARTIUM RIBICOLA (somebody may ask you this) pronounced Crow-nar-shum rye-bick-o-la.

DESCRIPTION OF THE HOST PLANTS: WHITE PINE: The blister rust fungus attacks only those pines which have their leaves - "needles" - in clusters of five. The eastern white pine - Pinus strobus (pronounced Pie-nus stro-buss) is the only five-needled pine native to the eastern United States. In the west, there are seven other native five-needled pines of which the two most important are Pinus monticola - western white pine, and Pinus lambertiana - sugar pine.

RIBES: All species of Ribes are susceptible to the blister rust, altho the European black currant

Ribes nigrum R. aureum R. vulgare

is the most susceptible species and is responsible for the long-distance spread and establishment of the disease.

For your information there follows a list of the principal species of Ribes which are found in Massachusetts.

Cultivated Ribes:

European Black Currant - Ribes nigrum (R. neye-grum) leaves quite pointed, broader than long, have resin dots only on the under side. New stems smooth and round. Stems and leaves give off strong odor when crushed. Fruit black, smooth, pungent to taste. Rarely escapes from cultivation.

Red or white currant - Ribes sativum (R. sat-ee-vum) Leaves rather thick, dark green, shaped something like a maple leaf. Fruit red or white, smooth, shiny, tart to taste. Escapes from cultivation quite commonly in Massachusetts.

Flowering currant - Ribes odoratum (R. o-door-ah-tum) Leaf entirely different from leaves of other Ribes, usually distinctly three-lobed, square-shaped at base, thick and rather leathery. Flowers yellow and fragrant. Fruit black. An ornamental shrub used on lawns and as hedge plants.

Commonly called clove or spice bush, and it is often difficult to convince people that it is a true currant. Varies markedly in susceptibility to blister rust but has been found heavily infected in many instances in Massachusetts.

Gooseberry - Ribes grossularia (R. grawss-you-lay-rea) Stems may be either smooth or prickly. Fruit greenish yellow or purplish red.

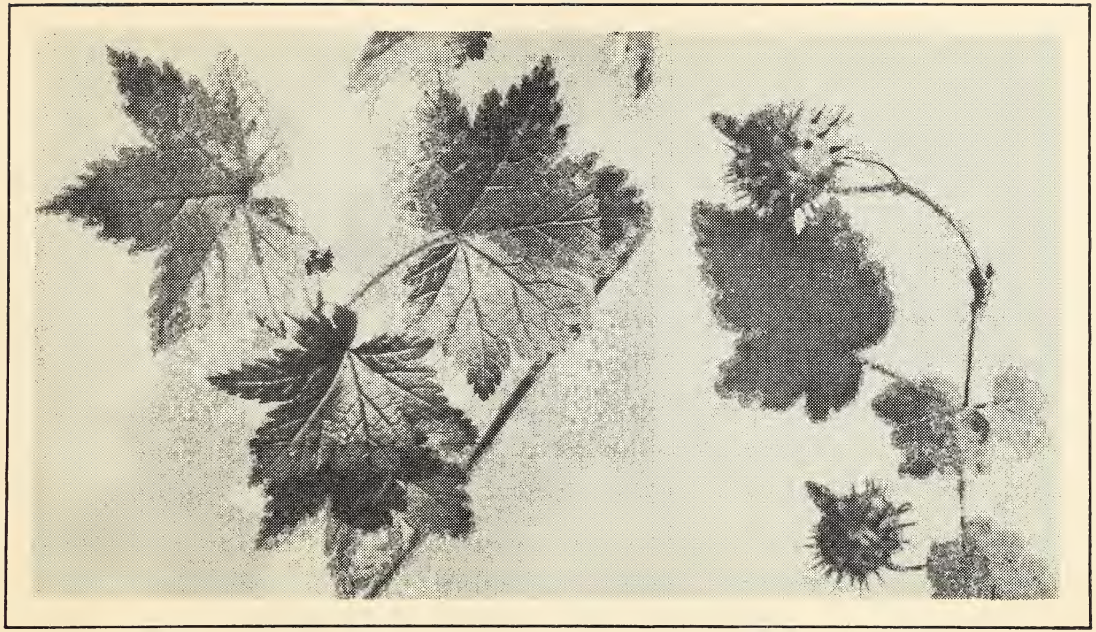
Wild Ribes:

Black currant - Ribes americanum (R. a-merry-cane-um) Leaves very thin, slightly heart-shaped, doubly toothed on the margin with small golden or amber spots (resin dots) on both sides. Bushes are often very tall; stems ridged. Fruit smooth, black. Sometimes cultivated.

Red currants - Ribes sativum (R. sat-ee-vum) Leaves thick, dark green. This is the same species as the cultivated red currant.

Swamp red currants - Ribes triste (R. tris-tee) Straggling

Ribes americanum R. grossularia R. triste



Ribes glandulosum R. cynosbati

or reclining, the branches often rooting freely. Leaves large and thick, hairy beneath, beautiful dark green, three-lobed, resembling that of the red maple. Fruit smooth, red, small. Uncommon in Massachusetts but found occasionally in Berkshire and Franklin counties.

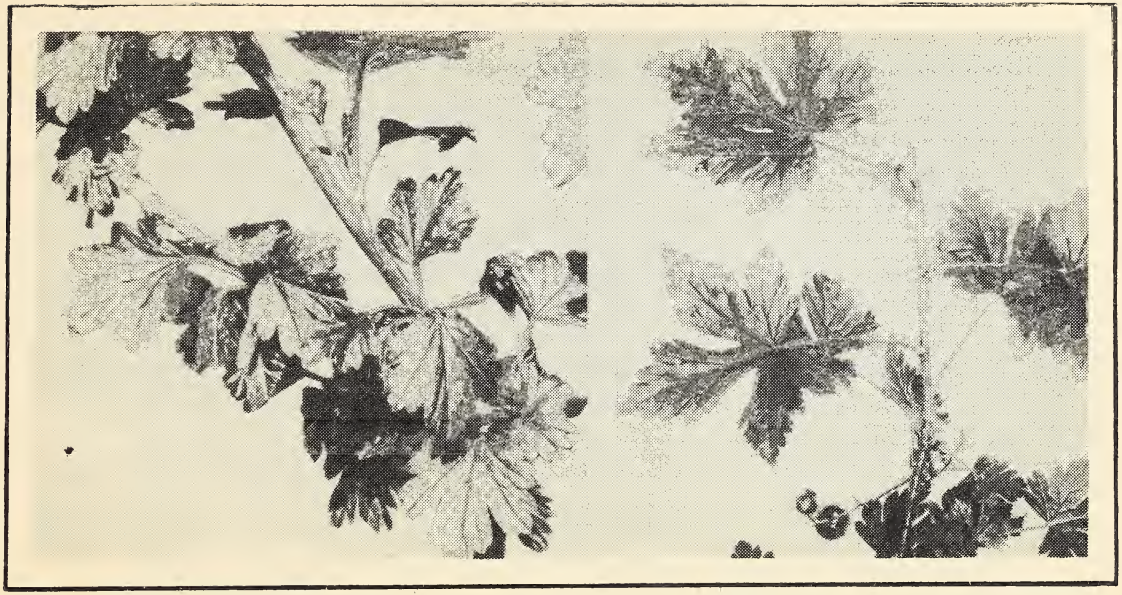
Skunk currants - Ribes glandulosum (R. gland-you-low-some) Trailing species mostly common in swampy woods. Propagates itself by trailing along the ground and taking root, developing upright shoots. Leaves thick, leathery, hairy below, broader than long. Fruit bristly, red, disagreeable to taste. The species gets its common name from the odor given off by the stems when broken.

Prickley gooseberry - Ribes cynosbati (R. si-noss-bat-ee) Bushes often very tall and large. Stems supplied with stout thorns and bristles. Leaves rather thin, soft and downy. Fruit with coarse, almost spiny bristles. Common in stone walls, pastures, and rocky ledges.

Smooth gooseberry - Ribes hirtellum (R. her-tell-um)
Usually small sized bushes. Leaves smooth, rather thick wedge-shaped at base. Fruit smooth, purplish. New stems supplied with soft spines. Fairly common in pastures and in swampy areas.

Prickly stemmed currant - Ribes lacustre (R. lah-cuss-tree)
Leaves thin, resembling those of R. cynosbati, but more deeply lobed, 5 to 7 lobed, smooth. Young stems covered with reddish prickles and slim thorns. Old stems slightly armed. Fruit dark purple, small, bristly, unpleasant to taste. Uncommon in Massachusetts but found occasionally in Berkshire and Franklin counties.

ORIGIN OF THE DISEASE: The disease probably originated in Asia and spread over Europe. First reported in Europe in 1857. The introduction of the rust into the U. S. resulted largely from the



Ribes hirtellum

R. lacustre

importation of white pine planting stock principally from German and French nurseries, where the stock had been exposed to infection. It was first discovered in North America at Geneva, New York in 1906 on Ribes, and in 1909 on white pine. There is ample evidence, however, to indicate that it was present in this country as early as 1897. at Kittery Point, Maine.

PRESENT DISTRIBUTION IN THE UNITED STATES: The blister rust is now generally distributed throughout New England and northeastern New York. It is also present in Pennsylvania, New Jersey, Virginia, West Virginia, Maryland, Ohio, Michigan, Wisconsin, Minnesota, and Iowa. In the west, it has been found in British Columbia and in the States of Washington, Oregon and Idaho and Montana.

HOW THE DISEASE SPREADS: Blister rust is transmitted by means of minute seed-like structures called spores, which are blown about by the wind or carried by currents of air.

Types of Spores: There are five distinct types of these spores, all but one of which function in the spread of the disease.

The first type (aeciospores) are produced on diseased pines early in the spring April 15 - June 15. These spores transmit the disease to currant and gooseberry leaves upon the under side of which a second type of spore is produced. Spores of this second type (urediniospores) are liberated about May 15 and seven generations of these may be produced during the season, thus intensifying the disease on Ribes.

In mid-summer a third type (teliospores) appear on the diseased Ribes leaves. These spores germinate and produce a fourth type known as sporidia and these transmit the disease to white pine trees.

A fifth type (pycnospores) appear on the diseased pine bark from June 7 to the winter. These spores are contained in small drops of a very clear, sweet-tasting liquid. As far as is known, however, this stage merely indicates the presence of the disease and these spores in no way act to transmit it.

DISTANCE OF SPREAD: Aeciospores unquestionably travel many miles and recent evidence obtained in the west, indicates a spread of at least 110 miles in one instance.

Urediniospores have been trapped up to a distance of 3200 feet.

Teliospores are not disseminated, but remain in the telial column.

Sporidia are effective under ordinary conditions to distances of 900 feet.

CHARACTERISTIC APPEARANCE OF THE DISEASE ON THE HOST PLANTS:

ON WHITE PINE: Infection takes place through the breathing pores of the needles during the season of sporidia production. There follows then a period of incubation of from 1½ to 3½ years before the blisters (aecia) burst through the bark of the diseased tree. During this incubation or dormant period, the symptoms of the disease are as follows:

(1st season) Small orange yellow spot usually produced from 6 to 8 weeks after the sporidium falls on the needle. This stage is not readily identified in the field.

(2nd season) Filaments of the fungus grow down the needle into the bark of the branch and spread out to a distance of from $\frac{1}{4}$ to 2 inches. The bark becomes pale yellow or slightly orange.

(3rd season) Canker enlarges, pycnial drops may begin to form by June 7 and continue up to the winter. When these drops dry up there remain scars - pycnial scars - which are very characteristic and make identification of the disease certain.

(4th season) In late spring or early summer, blisters appear usually in the zone of the pycnial drops of the previous season.

ON RIBES: The first evidence of the disease on the leaves of Ribes is the development of small patches of a yellowish appearance on the under side of the leaves. As the intensity of the infection increases, these spotted areas increase until they may completely cover the surface of the leaf. In mid-summer, brown hair-like or horn-like projections develop from these patches. These are called telial columns and are composed of the teliospores from which sporidia develop. These columns often become so abundant that they may completely cover the under surface of the leaf, giving to it a decidedly rusty appearance.

HOW BLISTER RUST CAN BE CONTROLLED: The critical point in the so-called life history of the fungus is that it cannot propagate itself on one host plant, but requires two distinct hosts. It is apparent, therefore, that if the two sets of hosts plants are separated widely enough so that the spores produced upon one cannot reach the other, the disease cannot spread. Control, therefore, simply involves the elimination of the less valuable host, which in most localities in Massachusetts is certainly the currant or gooseberry bush.

16 AVAILABLE PUBLICATIONS REGARDING BLISTER RUST:

By application to the Blister Rust Control-Agent:

U.S.D.A. Miscl. Publication No. 22 (Eastern Edition)
PROTECT WHITE PINE FROM THE BLISTER RUST

U.S.D.A. Miscl. Publication No. 27
BLACK CURRANT SPREADS WHITE PINE BLISTER RUST

U.S.D.A. Technical Bulletin No. 87
WHITE PINE BLISTER RUST - A COMPARISON
OF EUROPEAN WITH NORTH AMERICAN CONDITIONS

U.S.D.A. Simplified leaflet
PROTECT WHITE PINE FROM THE BLISTER RUST

By application to the Division of Blister Rust Control
U.S. Bureau of Plant Industry, Washington, D. C.
U.S.D.A. Dept Bul. 1186
WHITE PINE BLISTER RUST IN WESTERN EUROPE

U.S.D.A. Technical Bulletin 240
THE CHEMICAL ERADICATION OF RIBES

U.S.D.A. Technical Bulletin 261
LONGEVITY AND GERMINATION OF SEEDS OF RIBES PARTICULARLY R. ROTUNDIFOLIUM UNDER LABORATORY AND NATURAL CONDITIONS

U.S.D.A. Farmers Bulletin No. 1398.
CURRANTS AND GOOSEBERRIES - THEIR RELATION TO WHITE PINE BLISTER RUST.

JOURNAL AGRICULTURAL RESEARCH SEPARATE
THE RESULTS OF INOCULATING PINUS STROBUS WITH THE SPORIDIA OF CRONARTIUM RIBICOLA.

Agricultural Yearbook Separate 1182.
BLISTER RUST CONTROL IS EFFECTIVE WITH PUBLIC'S COOPERATION.

MIMEOGRAPHED ARTICLE
STUDIES OF RIBES ECOLOGY.

AVAILABLE PUBLICATIONS CONCERNING SUBSTITUTES FOR CULTIVATED RIBES

By application to Division of Blister Rust Control, B.P.I. Washington, D. C.

Mimeographed articles – "Edible Fruits Borne on Many Ornamental Shrubs.

"Substitutes for Currants and Gooseberries."

AVAILABLE INFORMATION REGARDING AGRICULTURAL SUBJECTS:

For general information on agricultural subjects, refer the questioner to the Office of the Extension Service, located in the district, or to the Massachusetts Department of Agriculture. Room 136 State House, Boston, Mass. The blister rust control agent has a supply of cards - SERVICE REQUEST CARD-AGRICULTURE which may be used for this purpose.

AVAILABLE INFORMATION REGARDING FORESTRY:

Matters pertaining to Forestry in Massachusetts, are handled by the State Department of Conservation. Persons requesting specific information on forest planting and other forestry problems should be referred to the Division of Forestry, Department of Conservation, 20 Somerset St., Boston, Mass. A card form - SERVICE REQUEST CARD-FORESTRY- may be used for this purpose. These cards can be obtained from the blister rust control agent.

FACTS ABOUT THE OCCURRENCE OF BLISTER RUST IN MASSACHUSETTS

The disease on white pine was first found in Massachusetts in a pine plantation in Andover, Essex County, June 24, 1909. Since then and up to Dec. 31, 1933 the disease has been reported on pine in 343 townships. The degree of infection varies, but areas of what may be called local general infection have been noted especially in Essex County, both northern and southern Worcester County, northern Plymouth County, western Hampden County, western Franklin County, and southern Berkshire County.

Local spot infection can be found throughout the State and it is safe to say that upon diligent search, diseased pines can be found in any town where white pine is abundant.

FACTS ABOUT THE PLAN OF CONTROL OF BLISTER RUST IN MASSACHUSETTS

The present plan for preventing further damage by the white pine blister rust in the State was inaugurated in May 1922. The plan provided for a service campaign of education, demonstration, and instruction, organized for the purpose of accomplishing general control of the disease by furnishing to all interested parties, through personal contact, the essential facts relative to this disease and the simple methods by which its further spread can be checked. In accordance with this plan, the U. S. Department of Agriculture, through its Office of Blister Rust Control, has assigned special agents to the more important pine-producing sections of the State to carry on this informational and service work.

The State, in carrying out its obligation, through the State Department of Agriculture, guarantees under the plan, to aid pine owners by providing field men to supervise the actual practice of control work, that is to say, to assist pine owners in locating and destroying

currant and gooseberry bushes which may be menacing valuable white-pine stands. The procedure has been to select a group of towns in each district each year, and to concentrate in these towns, so that the work might be handled systematically. In rendering service to the pine owner the State and Federal authorities are using the facilities which are at their disposal in an effort to fulfill an obligation to the community as a whole, while the responsibility for, and the actual cost of control work is borne by the individual owners whose interests are primarily at stake.

Effective as of April 1, 1930 an official regulation was issued by the Massachusetts Department of Agriculture, declaring that because of their susceptibility to blister rust infection, all specimens of European black currants are likely to become infected and are thereby subject to destruction, by the exercise of the authority provided by Section 22, Chapter 128, General Laws as amended.

From the inauguration of the Plan in 1922 and to the close of the 1932 field season, initial examinations were made on 1,690,826 acres of white pine producing lands and protective zones adjacent thereto. On this total area of land more than 9½ million wild Ribes were found and destroyed at an average cost of 12 cents per acre. During the same interval (1922-1932) it was necessary to destroy over 223,000 cultivated Ribes because of their location within infecting distance of more valuable white pines. In this work, involving the initial eradication of Ribes, nearly 14,000 cooperating land owners, including other State Departments, expended the equivalent of $72,000 in their own time or for the hire of laborers.

STATUS OF CONTROL

Except in a few odd areas in the State, the initial eradication of Ribes from the pine producing sections has been completed and all European Black Currants have been eliminated from about 94% of the land area of the State.

FUTURE REQUIREMENTS TO ACCOMPLISH PERMANENT CONTROL

There now remains the task of completing the State-wide eradication of the European black currant and any reeradication of Ribes which may be deemed necessary.

From experience to date, it is apparent that one examination of any pine area will not succeed in accomplishing the complete eradication of Ribes and in establishing permanent control of the disease. Sproute may develop from Ribes that were poorly uprooted; there will be an occasional bush missed in the first examination; there may be seedlings too small to be seen; and finally, it has been recently demonstrated that Ribes seeds remain dormant in the ground, and when conditions are favorable these seeds germinate and in time may partially restock the control area. Fortunately, not all of these conditions will prevail on any one area, but nevertheless they indicate the necessity for periodic examinations to keep an area effectively Ribes-free. The time period involved between eradication will vary of course, but it seems reasonable to say that a reexamination should

be made at least five years after the initial examination. In many instances, reeradication work will simply involve a reexamination or scouting of the area to determine conditions, while in other cases a new population of Ribes may be found which will require additional work to eliminate.

In many towns, Ribes were originally so few in number that it is quite possible that no further work will be required. In other towns, white pine was found in too limited an amount to justify further efforts to eradicate Ribes. In other words, the plan will be to restrict reeradication work to those towns in which our experience and records show that there is a substantial growth of white pine and where Ribes were initially found in considerable abundance.

A limited amount of reeradication work has already been performed. To the close of the 1932 field season 1,363 property owners had participated in such work on 309,000 acres of land. Wild Ribes numbering 475,817 were destroyed at an average cost of 9 cents an acre.

FACTS ABOUT THE MASSACHUSETTS BLISTER RUST LAW AND REGULATIONS

Blister-rust control work in Massachusetts is carried on by the Division of Plant Pest Control of the Massachusetts Department of Agriculture, under the authority of the provisions of Section 16 and 22, Chapter 128 of the General Laws as amended. These sections provide as follows.

Section 16: The Director of the Division of Plant Pest Control, and his assistants, may at all times enter any public or private grounds in the performance of any duty required by Sections seventeen to thirty-one, inclusive.

Section 22: If the Director, either personally or through his assistants, finds Ribes, that is, any variety of currants or gooseberries whether wild or cultivated, or five-leafed pines which are either infected with white pine blister rust, or so situated that in his opinion they are likely to become so infected, he or his assistants may destroy or cause to be destroyed such Ribes or five-leafed pines. In carrying out his duties under this section the Director shall as far as practicable cooperate

with the State Forester, local tree wardens, moth superintendents, city foresters and forest wardens.

Under Section 25 an owner has the right to oject to the removal of the bushes in writing within ten days to the Commissioner of Agriculture and such an appeal acts as a stay of proceedings until the appeal has been heard and decided.

If the decision to remove the bushes is sustained, the owner must then remove them or they will be removed by the Director or his assistants and the cost of such removal assessed upon the owner.

Under Section 23 of the same chapter provision is made for the compensation of the owner for the loss of cultivated Ribes destroyed under Section 22, provided written claim is filed with the Massachusetts Department of Agriculture within 30 days of the time the bushes are destroyed.

Under Section 27 the Department has issued an official order prohibiting the planting of Ribes in approximately 200 townships in the State. These are towns in which white pine is an important community asset and where it has been necessary to remove large numbers of cultivated Ribes.

Under Section 27 there has also been issued the official order providing that all plants of Ribes nigrum, wherever situated in Massachusetts are subject to destruction by the exercise of the authority of Section 22, Chapter 128, General Laws, as amended.

Federal Quarantine: Plant Quarantine No. 63 of the U. S. Dept. of Agriculture effective October 1, 1926 made inoperative the State quarantine established in 1918. One of the provisions of the federal act, however, provides that no five-leafed pines or Ribes can be shipped into Massachusetts unless accompanied by a permit from the Director. Division of Plant Pest Control, Mass. Dept. of Agriculture. Under this provision, permits are granted for the unrestricted entry of white pines but permits for Ribes are only granted for the shipment of such stock to towns not on the local control area list.

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FACTS ABOUT GENERAL CONTROL MEASURES

FIELD METHODS OF ERADICATING WILD RIBES:

There are no hard and fast rules that can be made to govern the choice of eradication methods. The best system to use will, of course, depend upon local conditions;, namely, the abundance and habit of Ribes growth in that section and type of territory being worked. Two major methods of eradicating Ribes by hand have been developed; namely preliminary scouting and crew formation.

Preliminary Scouting: Preliminary scouting is most effective where the Ribes are comparatively few, and grow more or less in patches, or in a territory where only certain types contain Ribes. This scouting system is a prime factor in reducing the cost of eradication, and should be used in every area where conditions are favorable. The success of this method will invariably depend on the ability of the scout. No set rules can be applied to scouting. It is a thing that requires natural ability in handling oneself in the woods, and knowledge of Ribes and their habit of growth. A scout must have good judgment, keen eyesight, and must be conscientious in his work. On his re-

ports will depend what eradication work is to be done. The scout will first examine thoroughly those places where he knows Ribes are liable to be found, such as swamps, stream courses, fence rows, roadways, pastures, and sites that were disturbed by logging, windthrows, fire, or other mechanical means, within the past 3 to 5 years. The intervening areas will be covered only roughly. For instance, in a territory where there are no skunk currants and practically no gooseberries on the dry ridges, he would confine most of his efforts to scouting the lowlands, along the stream valleys, little runs, and hillside swamps. To check himself, he would occasionally run a strip along the ridges. The results obtained by individual scouting are only as effective and efficient as the man who is doing the work. BE THOROUGH! Do not throw out an area as Ribes-free until you have "sampled" it well. Scouts are held responsible for all areas which they designate as Ribes-free. Be on the safe side and be certain of your ground before reporting.

Crew formation method: A crew in strip formation is used where the wild Ribes are fairly abundant and scattered more or less over all the area being worked. In such places, a systematic covering of the ground is essential to be certain that no Ribes are missed.

The ideal crew seems to be five men and a foreman. Larger crews have been used and recently crews of ten men, two straw-bosses behind the line, and a foreman behind them, have been employed. The larger crews work best when split up into two units covering nearby areas, the foreman dividing his time between the sections. When he is absent from a unit, its work is directed by a sub-foreman. The advantage of larger crew units is that the cost of supervision is less.

With the six man crew, the best results are attained when the foreman works from fifteen to twenty-five feet in back of the line, following a zigzag course, and checking the work of each man. The linemen should be especially checked as they are liable to miss more bushes because of their extra duties. When the foreman finds Ribes behind a man, it is usually best to call his

attention to the oversight rather than for the foreman to pull the bushes.

When the strip formation is used, the men line up about ten feet apart, the distance apart varying with conditions in the type being worked. The two end men act as linemen, one following a line of guides or marks while the other is making a new line. The man who marked the line on the first strip follows it back on the second, while the other lineman marks a new line. In this manner the crew systematically gridirons an area with parallel strips, looking for Ribes on every foot of the ground. The man next to the one following the line should not only be separated the proper distance from his lineman, but should also be one or two feet in back of him, and so with each man down the line. This arrangement will allow each man to see the one next to him, and thus keep his proper distance.

Where Ribes are comparatively few and occur more or less in patches, a method has been tried out where an entire crew scouts in line formation with spaces of fifty feet or more between the men. When Ribes are encountered, the lineman marks his line conspicuously at this point, and the men close in to eradicate the bushes. After the Ribes have been pulled, the crew

formation is reestablished and the men proceed on their strip.

Marking the Line: The amount of territory that a lineman can cover in looking for Ribes, and still run his line, will depend on conditions and the ability of the man. Usually the lineman can only effectively cover half as much ground as the other men in the line. A good lineman will gage the width of his strip by his ability to keep up with the crew, and still do good work. If he sees he is getting behind the crew, he can gradually close in and do a narrower strip until he has caught up with the line. The lineman should endeavor to run as straight a line as possible. He can do this to a marked degree, if he always places his tag or other man in line with the two previously hung tags on the same strip. Usually the best results are accomplished when the lineman walks on his line, and looks for Ribes on one side of the line during the entire length of the strip. In running his strip and marking the line, he does not look for Ribes beyond the point where he places his paper or other mark. Returning on the next strip, the lineman who marked the line follows it back, and looks for Ribes only in the area between his line and the strip of the man next to him. The other men "dress up" on the one who is following the line, being careful to keep the proper spacing.

Most every lineman will have his own definite preference as to the best system of marking the line. No one system of marking appears successful in meeting all conditions. The paper trail (Small pieces of paper dropped on the ground) has proved very effective in working types that are, more or less free from dense undergrowth. This method has the advantage of keeping the lineman's attention on the ground. In a dense brush type, broken branches make a good line, provided enough branches are broken so that the line may be followed easily. However, breaking branches take considerable time. A more efficient method in such brush areas is to mark the strip boundary with string. The lineman carries a cone of light string and it unwinds as he walks, provided the cone is placed on a stick and the small end of the cone is pointed backwards. The string is not salvaged, of course, after being placed.

In types with little or medium undergrowth, pieces of paper 6" x 6" stuck on the brush are effective. Bark blazes should be avoided as many owners seriously object, and rightfully so, to the

blazing of trees, because such wounds give entrance to fungi. When pieces of paper are used for tags, they can easily be hung on conifers, and made to stay there. The tags should always be hung so that the broad face of the tag will be towards the lineman when he returns on the next strip.

Spacing: The spacing between the men in line should depend upon two conditions; namely, the abundance and habit of growth of the Ribes, and the density of the undergrowth. In places where the undergrowth is thick, and there are many Ribes, the men should be placed as close as six to eight feet, in order to make sure of getting all the bushes. From this extreme, the spacing may widen to suit conditions. Wide spacing, such as twenty feet or more, should only be used where the bushes are very few and scattered, or grow more or less abundantly only in scattered patches, as mats of skunk currants. There is always a tendency on the part of the men to get too far apart in

line, thus causing Ribes to be missed between the individual strips. One of the chief duties of the foreman is to see that proper spacing is being maintained by the men in line. A capable man in the center of the line can greatly aid the foreman by helping to regulate the spacing of the men on either side of him.

Speed: The speed of a crew will also depend upon the abundance of Ribes, and the type of territory being worked. There appears to be a certain medium speed that is most effective in working each type. When the men work too slowly their minds wander, the eyes become dull, and in consequence the men step over the bushes. However, a crew should not go to the other extreme, for in this case many bushes are also missed. A medium speed should be maintained that is sufficiently fast to keep the men alert and active, but slow enough to enable the men to find and pull the bushes. Experience only will teach the foreman the proper speed for each type. The best way for him to ascertain this medium speed is to check behind the crew. If too many Ribes are being missed by the men in the line, there is a reason.

It can usually be traced to improper spacing, or speed. The important thing is to get out the Ribes; covering territory does not mean much unless the eradication work is well done.

Working Stonewalls and Fence Rows: More Ribes are missed along fence rows in proportion to the number present than in any other type. This is usually caused by too rapid work, and the fact that the men's attention is liable to be drawn to other things than eradication. Usually the best system of working fence rows is to detail two of the most conscientious men to do this work, while the remainder of the crew are kept on straight eradication under the direction of the foreman. The foreman should insist that these two men cover their work a second time, and change places on the check. These Ribes in the open are the dangerous ones. Here the wind will strike the bushes, and distribute the spores for considerable distance. Any missed bushes in such places are sure to be seen by the public, and the entire eradication job judged by this example.

Pastures: Special care is also essential in working pastures. Because of the open nature of the ground, the men have a tendency to increase their spacing and speed, and in consequence many bushes, even large ones, are missed. Pastures and all open lands should be worked very thoroughly, especially around rockpiles, ledges, and patches of brush. Ribes frequently grow in such places.

Roadways: Great care should be exercised in working roadways, as the bushes missed here are exceptionally dangerous in spreading the disease, and sure to be an advertisement of poor work. The cutting of brush along roadways frequently results in the development of stubby Ribes plants. Extra vigilance is required to find such bushes. If the roadside is too wide for one man to cover it alone, it may be best to have part of the crew run a strip. It is always advisable to do both sides of the road, even when this is a boundary of the control area. When working roadways, the men come in contact with the public more than in any other type, and should in consequence be exceptionally careful of their actions and work.

Lost Time and Lost Motion: If every man in the crew would regard this work as if he was personally paying for it, there would be very little tendency toward lost time. The more serious evil of lost time is that usually some local person sees this and a wild story spreads regarding the men "loafing on the job". A few such stories scattered around town, will more than counteract all the good work a crew can do. Get the crew into the field at the appointed hour for starting work. If the foreman and crew are seen loitering about town in the morning, it creates an unfavorable impression.

Lost motion in a crew is due to careless, inefficient direction of the work. Efficiency in crew work does not imply "driving the men"; it simply means thoroughness of Ribes eradication, and preventing an excess of wasted effort. In directing a crew it is not essential or even desireable to appear officious or too bossy but the use of such expressions as "what do you say boys?", "We're off", "Let's go!" will help to keep everyone alert. Let the slogan be "KEEP MOVING".

The following methods have been successfully tried out to overcome lost motion in the crew work. When a man found a few Ribes on his strip, instead of holding up the entire crew until he had pulled the bushes, the following two systems were found to be more effective. The one who found the bushes, designated these to the foreman, who pulled them, while the crew continued on their strip. In the other method, the men who found the bushes stopped and pulled them, the foreman temporarily taking this man's place in line. When the man had eradicated the bushes, he checked back of the crew until he reached the line, then exchanged places with the foreman.

If two men found a few bushes on their strips about the same time, the other men were directed either to search for Ribes a short distance ahead, or to check in back of the line. As soon as the first two men pulled their bushes, the line was reestablished, and all the men continued on their strip. If many Ribes were found on one or more men's strips, the linemen marked their lines and the whole crew came over to help pull the bushes.

When the man marking the line was unable to keep up with the crew instead of holding up the work he simply closed in and did a narrower strip, or even in some cases, came along hurriedly in back of the man next to him in line.

Checking: One of the most essential factors in producing good eradication results is the checking of the work performed. by this means, a crew has an opportunity to see exactly what they are accomplishing. It is only by constant checking that uniformly thorough eradication is assured. When you are in areas where patches of Ribes are quite abundant, check "early and often".

Removal of the Roots: In pulling the Ribes, great care should be used to make sure that all the roots are destroyed. There is absolutely no excuse for leaving the roots after a bush has been found. GET THE ROOTS!

Radius of Vision: It is very difficult to do effective work if one

attempts continually to look vertically down on the ground for Ribes. If one increases this angle of vision to forty-five or fifty degrees, and thus looks for Ribes ahead of him a distance at least equal to his height, instead of searching for bushes near his feet, he will find more Ribes and will become less tired. If a man covers a strip six to ten feet wide on either side of him, he must continually move his head and eyes. When a foreman sees a man going along in a straight line and not moving his head, he can be convinced that the man is not covering his full strip, and that bushes are sure to be missed.

Eradication work with property owners: When you make an appointment with an owner - BE THERE! When a pine owner or an inexperienced laborer is working with you, particularly along a stonewall, it will be necessary to continually check his work to see that he is not missing bushes, and to be certain that he is getting out the roots. In checking on the other fellow's work, be sure that your own work is not at fault. Impress upon each owner that he should

look upon Ribes as pests and that he should endeavor to eradicate them from his lands in the same way that he keeps weeds out of his garden. Tell him also, that the spring, usually from the last week in April to about the 10th of May, is the best time to check over his land; for the reason that Ribes are about the first plants to put forth their leaves and therefore, they can be more easily seen at that season.

REMOVAL OF CULTIVATED RIBES: It is most important for all field men to know that the authority for the removal of cultivated Ribes is vested entirely in the STATE DEPARTMENT of Agriculture by STATE LAWS. NEVER SAY that the federal government has any such authority. The federal department has no such authority. Remember this!

Before removing cultivated Ribes, field men should secure specific instructions from the blister rust control agent in charge. In addition to such specific directions, the following general instructions should always be followed carefully:

1. Inform the owner concerning the disease, control work, and the necessity for the removal of the bushes.
2. If the owner objects to removal or brings up the question of compensation, try to impress upon him his duty to help control the disease in his local community and ask him to donate his bushes to the cause of the protection of the white pine in his town. Call his attention to the fact that during the past ten years (1922-31) only 3 owners in every 100 have refused to remove their

bushes without reimbursement. If this fails, and the owner absolutely refuses to have the bushes removed, refer the case to the blister rust control agent in charge, for his action and disposal.

3. Examine, classify and record all cultivated Ribes when you first find them. If they are not be be removed immediately make a record on a blue Cultivated Ribes Removal Card. (In special black currant work, use a buff card instead of blue)
4. Upon the removal of any cultivated Ribes, fill out a white Cultivated Ribes Removal Card. (In special black currant work, use a salmon card instead of white. Be sure to enter on the cards in every case, the town and block number in addition to the address of the owner. In classifying the bushes, use the following scale: Class I: Fruiting plants 4 years or older

   (a) In good state of cultivation

   (b) In sod and uncultivated but not entirely neglected

Class 2: Fruiting plants 2 to 4 yrs. old
(a) In good state of cultivation
(b) In sod and uncultivated, but not entirely neglected

Class 3: Fruiting plants, run down, depreciated by age or lack of recent care.

Class 4: Plants in sod and drying of neglect

Class 5: Young plants, not fruiting (determine date planted)

Class 6: Plants entirely neglected, worthless

FACTS ABOUT THE DUTIES AND RESPONSIBILITIES OF BLISTER RUST FIELD MEN

His Duties: The blister rust field man is to carry out all instructions given him by the district blister rust control agent to whom he is responsible. His job or duty is to assist with, supervise, or inspect Ribes eradication worked performed either by individual cooperators or by crews. When engaged in preliminary scouting, he is expected to use his best judgment and be thorough in his work. When directing individuals, such as pine owners, or crews of laborers, he is responsible for the work these men perform under his guidance and must see that the work is effective and effecient.

Every blister rust field man is required to make out certain daily, weekly and monthly reports, instructions regarding which, will be given him by the Agent as occasion requires. All records should be made out promptly, correctly, neatly and completely and submitted on time. In addition to these routine reports, employees will be

expected to furnish any other information that the Agent may from time to time require.

You will be furnished with Field Maps and will be given necessary instructions by the Agent as to their use and development. It is essential that these maps be kept up to date to be of any value. This means that data should be recorded daily and while in the field as the work progresses.

HIS RESPONSIBILITIES: Blister rust field men are responsible directly to the blister rust control agent. All field men, however, are expected to cooperate at all times and to the best of their ability with any State or Federal blister rust officers who may visit them. These men do not come to find fault, but rather to assist in improving our work. A friendly spirit of cooperation between all concerned will be of great benefit to the work.

As public servants, remember that your work involves the expenditure of public money raised by taxation, and be sure to return full measure for value received. You should remember that your work is subject to the critical eye of the public. See to it that your conduct and that of the men associated with you is such that criticism will not be adverse. Whenever you are working alone, be sure to keep on the move. Remember also that your conduct after working hours is just as important as that during the day. If anyone seeks information from you regarding blister rust and its control, answer the questions if you can and if you can not or if more detailed information is needed, refer the inquiry to the blister rust control agent. The public is entitled to know what we are doing, how we are attempting to do it, and why!

PREVENT FOREST FIRES! At all times care must be exercised to prevent forest fires! Smoking on the job has a most unfavorable impression on the general public - the tax payers - and is really dangerous from the standpoint of forest fires. For that reason especially -

SMOKING IN THE WOODS CANNOT BE TOLERATED

You will of course, do everything possible to put out any fire that you discover, and immediately notify the local fire warden if additional assistance is needed.

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The following advice originally given to the blister rust workers in New Hampshire, by State Blister-Rust Leader Newman of that State, is applicable to the workers in Massachusetts.

SEE THAT YOU AND YOUR CREW ARE EVERLASTINGLY ON THE JOB!

THE PUBLIC WILL BE WATCHING

SHOW THEM

THAT BLISTER-RUST MEN MEAN BUSINESS

The cooperation of all blister-rust workers is earnestly solicited so that we may continue to have the support and endorsement of the public in the service which we are endeavoring to render.

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FACTS ABOUT OTHER PESTS OF WHITE PINE

Relatively speaking, white pine is not susceptible to many plant pests, but there are a few which do attack the species to some extent and the injury which they inflict is often mistaken for blister rust. In order to assist you in making intelligent reply regarding these few rather common pests, the following brief descriptions are included at this point. These pests include a few insects; namely, the white-pine weevil, Pales weevil, the pine bark aphid, mound-building ants. One fungus commonly known as Phoma is also of importance. Finally, the so-called needle blight, which apparently cannot be traced either to insect or fungous disease, is mentioned briefly.

THE WHITE PINE WEEVIL

Brief description: The unfailing sign of the presence of white-pine weevil is the wilting and dying back of the terminal or leading shoots of white pines. It is partularly noticeable

on trees of relatively small size, 2 to 15 feet in height. This injury is the result of a process of girdling, due to the activity of a small beetle which lays its eggs in the terminal shoot. These eggs hatch into small white grubs which immediately begin feeding just beneath the bark on the wood of the shoot. As the grubs increase in size, they feed deeper into the wood, working downwards. The leader is soon girdled and immediately begins to wither and turn brown. The result of this destruction of the main shoot is that the tree becomes crooked, since, after the destruction of the terminal shoot, one of the branches grows upwards to make a new trunk. Repeated attacks result in a decidedly stunted and forked tree.

Life history and description: The winter is passed by the adult insects - reddish brown to very dark brown beetles about one-quarter of an inch long, with a rather stout, long, snout - within the shelter of the leaves or refuse under the trees. The beetles resume activity from March to the middle of May and feed upon the bark, sap and buds of the leading shoot.

They cut small holes in the shoot and deposit their eggs therein. After a few days, the eggs hatch and the resulting larvae - white, footless, grub-like, about one-quarter of an inch long when full grown - begin feeding inward and downward, girdling the tissues of the shoot as they progress. By August, the larvae construct nest like fibrous cells in the wood and transform into pupae - creamy white with brown head and about the size of the adult. After resting a short time the pupae transform to the adult or beetle stage. A neat round hole is then eaten through the confining wall of the host, and the beetle emerges.

Method of control: No practical control measures, in the case of an extensive area of white pine, have been developed, except through proper spacing and species-mixtures. In the case of a few trees, the most effective method has been the cutting off and burning of the attacked leaders or terminal shoots before the

adults emerge in August. The close planting of the young trees used in establishing a plantation, is effective in partially preventing the deformation of the young trees. Where pines are growing in groups with older trees, there is apparently less damage by the weevil. Plantations and natural pine stock in the open, suffer the most from attack by this insect. In heavily infested plantations it has been found possible to salvage the plantation by girdling the heavily weeviled dominants to release the uninfested intermediate and suppressed trees.

Confusion of the injury with blister rust! The average individual associates the weevil injury with blister rust simply because of the rusty color of the dying shoot. None of the other characteristics of blister rust are present in the case of weevil damage and blister rust injury is seldom confined so characteristically to the terminal shoot.

PALES WEEVIL

Brief description: Young seedling or sapling pines are often seriously injured by the attack of small snout beetles known as the Pales Weevil. These insects are ravenous feeders, eating the tender bark from young pines or the younger bark on larger sized pines. When the attack is sufficiently severe, large numbers of the smaller trees may be completely girdled, while on the older trees, large numbers of the smaller branches all over the trees may be killed.

Life history and description: The adult beetles – dark, chestnut-colored weevils, 3/8 of an inch in length – are responsible for the injury done. The beetles feed only during the night, so it is almost impossible to detect them on the plants which they are attacking. They hide near the trees during the day time, under bits of wood, stones, or other refuse.

Methods of control: There is no practical control of this insect, but serious damage can be avoided by not planting pine trees in cut-over areas for at least three years after the timber has been cut. Damage may be materially reduced by pruning the slash over the freshly cut stumps, and utilizing the logs before spring. The point is that the insects are attracted by the odor of the freshly cut pine stumps, logs, boards, or even slash.

Confusion of the injury with blister rust damage: There should be no reason for confusing the injury caused by the activities of this insect, with that of blister rust. Examination will readily disclose the distinctly "chewed" condition of the bark, especially when the injury has been freshly inflicted.

PINE BARK APHID

Brief Description: The pine bark aphid is a true plant louse, but is rarely seen, since usually it is hidden beneath a mass of white, cottony, secretion. These cottony masses occur in greatest abundance on the trunk and large branches of the host and when numerous are very conspicuous. The lice occur in large numbers and take an immense amount of vitality from the trees attacked. Pines attacked by this insect become sickly the leaves turn yellow, limbs may die and occasionally the entire tree succumbs. The white patches on the trunks or branches of the larger sized trees disfigure and seriously detract from their appearance.

Methods of control: In plantations, these aphids may be destroyed by spraying the trees early in the spring about the time new growth starts, with 40% nicotine sulphate -- "Black leaf 40" -- used at a dilution of one part nicotine to 800 parts of water (1-800) dissolving 1 ounce of soap in each gallon of

water. Kerosene emulsion and soap and water solution are also used effectively.

Confusion of the injury with blister rust damage: Of all the pests of white pine, the work of the pine bark aphid is most often confused with damage by blister rust. The only explanation is a psychological one, due to the fact that these colonies of aphids are so strikingly white, that persons simply think of the name white pine blister rust. There is perhaps one similarity in the nature of the damage, for when a pine is seriously attacked there usually develops a general browning of the foliage, producing a condition often referred to as the "yellows." Following a heavy infestation of these insects, there often develops on the bark of the trunk and branches, a very black sooty deposit. This growth results from the fact that the aphids secrete a sweetish liquid, known as "honeydew," which is an ideal medium for the development of the spores of the sooty fungus.

Brief description: The so-called mound-building ants are of considerable importance because of their attacks on small pines under six feet in height and they often destroy all vegetation around their nests for a radius of twenty feet. The ants are supposed to kill the trees by injecting formic acid into the tissues of the main stem at a point just above the ground. The acid coagulates the cell contents, thus preventing the downward flow of sap.

Methods of control: These ant colonies are not easily destroyed, as the queens, or mothers, live deep down in the nest, often five or six feet below the surface of the ground, and unless these are killed, the colony will continue to live. The use of carbon bisulphide has, however, proved very satisfactory in destroying the colonies. A pint or so should be poured into the center of the mound if it is a good sized one. A few holes punched into the mound with a stick will assist in allowing the gases to penetrate. A few shovelsfull of dirt

should be thrown over the mound to prevent the escape of the ants as they endeavor to get away from the gas.

Carbon bisulphide gas is heavier than air and penetrates deep into the nests. The liquid evaporates readily upon exposure. CAUTION! Carbon bisulphide is very inflammable and should be used with care.

Confusion of the injury with blister rust damage: The injury caused is a shrinking of the tissues, causing a girdle. Associated with this constriction, is a yellowish discoloration of the adjacent uninjured bark. In other words, the damage is strikingly like that of blister rust, except that there is no swelling as in the case of a blister rust canker. However, when such injury is noted in the woods, careful search will always disclose the existence of one or more mounds nearby and a very pronounced area in which the trees are either dead or dying.

PHOMA

Brief description: Oftentimes pines will show "flags" that give every indication of the presence of blister rust, at least from a distance. Upon close examination, however, it is found that the injury is due to the attack of a fungus of the genus Phoma (pronounced Fo-mah). This fungus causes a shrinking or constriction of the tissues where the bark and cambium have been killed. In the dead bark there is usually present large numbers of small black pustules. There is, however, no yellowing of the healthy bark above and below the canker as in the case of blister rust. The needles of a branch attacked by Phoma are usually reddish in color rather than the characteristic straw color of the blister rust "flag." Phoma is often found in plantations, particularly where the planting has

been poorly done, or where the trees have unfavorable conditions to contend with.

Control: There is no control, but it is always advisable to recommend the destruction of a small infected specimen or of the diseased branches of a larger tree.

Confusion of the injury with blister rust damage: The constriction closely resembles that of the blister rust canker, but no discoloration of the healthy bark above and below the constriction is present. There is no marked swelling of the tissue as in the case of blister rust. The injury, however, is quite often confused with that of blister rust, especially in the case of young trees growing in pine plantations.

NEEDLE BLIGHT OF PINES

General description: The term "white-pine blight" has been rather loosely applied to a number of troubles. In general, however, the term is applicable to the condition which has prevailed in the past in several sections, where individual trees or groups of trees have suddenly turned brown or "rusted," and have been most conspicuous in the landscape. There is some difference of opinion as to the cause of the injury, but it is generally agreed that it is not caused by either insects or fungi. The best of opinion seems to be to the effect that the injury is due to one of two causes; namely, a winter injury causing the death of extensive portions of the sap wood, or an injury of some sort to the entire root system of the trees, either of which would result in a shortage of water for the use of the needles and cause them to dry up and turn brown as they do in the case of this blight.

Control: Since the trouble is apparently physiological there is no remedy.

Confusion of the injury with blister rust damage: This trouble when at all prevalent is very generally confused with blister rust probably because of the rusted appearance of the foliage of the trees affected. In the case of the needle blight, the entire tree becomes rusted and the condition of "flags" is entirely absent. The color of the foliage also has a characteristically reddish tinge. None of the usual symptoms of blister rust are present.

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WHAT ABOUT THE CHESTNUT? IS IT COMING BACK?

There is no more frequent inquiry met with in the field than the above query regarding the possible reestablishment or "come back" of the native American chestnut tree.

The chestnut blight was first found in the U. S. in 1904 in Bronx Park, New York City. It spread rapidly northeastward, westward, and southwestward. By 1926 nearly all the mature chestnut in southern New England, southeastern New York, New Jersey, eastern and central Pennsylvania and Maryland, and northern Virginia had been killed. As noted in Farmers Bulletin #1641 on the "Chestnut Blight" the disease now extends over the chestnut area of the Southern Appalachians. As a result of this phenomenal spread of the disease, it has been generally conceded that there is no practical method of stopping its spread.

In Massachusetts and in other sections in fact, sprouting has taken place from blight-killed chestnut trees. At the present time,

some of the sprouts attain considerable size, frequently produce nuts, and in many cases do so in spite of the blight cankers in the stems. Just what the ultimate result of this struggle between host and parasite will be, is problematical. In time an immunity may develop. It is reasonable to say, however, that the species as a producer of an economically important crop of timber, will not "come back" in this generation. It may, in the next.

The Division of Forest Pathology has introduced many strains of the forest type of Asiatic Chestnuts which are very resistant to the blight under Asiatic conditions. The Department is interested in receiving reports of Asiatic Chestnuts which have survived the blight and reports of unusually resistant American Chestnut trees and sprouts. All Asiatic Chestnuts are worth reporting, but it is only very exceptional American Chestnuts that are worthy of noting.

The fact remains, however, that as a result of the chestnut blight, there has almost vanished from the forests of the country a most valuable timber tree species. The chestnut was particularly valuable to the farmer and small woodlot owner who was able to derive a relatively quick return because of its rapidity of growth and sprouting ability.

While the blister rust differs entirely from the chestnut blight, the almost complete disappearance of the chestnut can be cited as an example of what one fungous disease has wrought.